

**What is claimed is:**

1. A system for diagnosing operation of a delta pressure sensor used with an internal combustion engine, comprising:

5 an intake manifold and an exhaust manifold each operatively coupled to the engine;

an EGR conduit fluidly coupled between the intake and exhaust manifolds;

a flow restriction mechanism disposed in-line with the EGR conduit, the delta pressure sensor producing a delta pressure signal indicative of a pressure differential  
10 across the flow restriction mechanism; and

a control computer comparing the delta pressure signal to a modeled delta pressure value modeled as a function of at least engine speed and one of engine load and engine output torque percentage, the control computer diagnosing a fault state of the delta pressure sensor based on the comparison.

15 2. The system of claim 1 wherein the flow restriction mechanism is an EGR valve having an actuator responsive to an actuator signal to control exhaust gas flow through the EGR valve;

and wherein the control computer is configured to produce the actuator signal.

20 3. The system of claim 1 further including an EGR valve having an actuator responsive to an actuator signal to control exhaust gas flow through the EGR valve;

wherein the flow restriction mechanism is disposed in-line with the EGR conduit between the EGR valve and the intake manifold.

25 4. The system of claim 1 further including an engine speed sensor producing an engine speed signal indicative of engine rotational speed;

and wherein the control computer is configured to determine an engine load value as a function of engine fueling, the control computer determining the modeled  
30 delta pressure value as a function of the engine speed signal and the engine load value according to a predefined delta pressure model and determining a residual value as a

difference between the delta pressure signal and the modeled delta pressure value, the control computer diagnosing the fault state of the delta pressure sensor based on the residual value.

5           5.       The system of claim 4 further including an EGR valve having an actuator responsive to an actuator signal to control exhaust gas flow through the EGR valve; and wherein the control computer is configured to control the actuator signal to command the EGR valve to a predefined valve position prior to determining the modeled delta pressure value.

10           6.       The system of claim 4 further including a turbocharger operatively coupled to the intake and exhaust manifolds, the turbocharger having a variable geometry turbine (VGT) mechanism with an actuator responsive to an actuator signal to control a swallowing capacity or efficiency of the turbocharger;

15           and wherein the control computer is configured to control the actuator signal to command the VGT mechanism to a predefined VGT position prior to determining the modeled delta pressure value.

20           7.       The system of claim 4 further including a memory having a delta pressure sensor diagnostic flag stored therein;

              wherein the control computer further includes a flag counter operable to increment a count value if the residual value exceeds a threshold residual value and to otherwise decrement the count value, the control computer diagnosing the fault state of the delta pressure sensor by setting the delta pressure sensor diagnostic flag if the  
25           count value exceeds a high count threshold and clearing the delta pressure sensor diagnostic flag if the count value drops below a low count threshold.

30           8.       The system of claim 7 wherein the control computer further includes diagnostic enable logic configured to enable operation of the flag counter only if a number of diagnostic enable conditions are met.

9. The system of claim 8 wherein the diagnostic enable logic is configured to enable operation of the flag counter only if the number of diagnostic enable conditions are met for a calibratable time period.

5 10. The system of claim 1 further including an engine speed sensor producing an engine speed signal indicative of engine rotational speed;

and wherein the control computer is configured to determine an engine output torque percentage, the control computer determining the modeled delta pressure value as a function of the engine speed signal and the engine output torque percentage  
10 according to a predefined delta pressure model and determining a residual value as a difference between the delta pressure signal and the modeled delta pressure value, the control computer diagnosing the fault state of the delta pressure sensor based on the residual value.

15 11. The system of claim 10 further including an EGR valve having an actuator responsive to an actuator signal to control exhaust gas flow through the EGR valve;

and wherein the control computer is configured to control the actuator signal to command the EGR valve to a predefined valve position prior to determining the modeled delta pressure value.

20 12. The system of claim 10 further including a turbocharger operatively coupled to the intake and exhaust manifolds, the turbocharger having a variable geometry turbine (VGT) mechanism with an actuator responsive to an actuator signal to control a swallowing capacity or efficiency of the turbocharger;

25 and wherein the control computer is configured to control the actuator signal to command the VGT mechanism to a predefined VGT position prior to determining the modeled delta pressure value.

30 13. The system of claim 10 further including a memory having a delta pressure sensor diagnostic flag stored therein;

wherein the control computer further includes a flag counter operable to increment a count value if the residual value exceeds a threshold residual value and to otherwise decrement the count value, the control computer diagnosing the fault state of the delta pressure sensor by setting the delta pressure sensor diagnostic flag if the count value exceeds a high count threshold and clearing the delta pressure sensor diagnostic flag if the count value drops below a low count threshold.

14. The system of claim 13 wherein the control computer further includes diagnostic enable logic configured to enable operation of the flag counter only if a number of diagnostic enable conditions are met.

15. The system of claim 14 wherein the diagnostic enable logic is configured to enable operation of the flag counter only if the number of diagnostic enable conditions are met for a calibratable time period.

16. The system of claim 1 further including a memory having the modeled delta pressure value stored therein in the form of a delta pressure threshold value based on a predefined delta pressure model;

and wherein the control computer is configured to diagnose the fault state of the delta pressure sensor based on the comparison between the delta pressure signal and the delta pressure threshold value.

17. The system of claim 16 further including an EGR valve having an actuator responsive to an actuator signal to control exhaust gas flow through the EGR valve;

and wherein the control computer is configured to control the actuator signal to command the EGR valve to a predefined valve position prior to diagnosing the fault state of the delta pressure sensor.

18. The system of claim 16 further including a turbocharger operatively coupled to the intake and exhaust manifolds, the turbocharger having a variable

geometry turbine (VGT) mechanism with an actuator responsive to an actuator signal to control a swallowing capacity or efficiency of the turbocharger;

and wherein the control computer is configured to control the actuator signal to command the VGT mechanism to a predefined VGT position prior to determining the modeled delta pressure value.

19. The system of claim 16 wherein the control computer is configured to command the engine speed to a predefined engine speed range prior to diagnosing the fault state of the delta pressure sensor.

20. The system of claim 16 further including a memory having a delta pressure sensor diagnostic flag stored therein;

wherein the control computer further includes a flag counter operable to increment a count value if the delta pressure signal exceeds the delta pressure threshold value and to otherwise decrement the count value, the control computer diagnosing the fault state of the delta pressure sensor by setting the delta pressure sensor diagnostic flag if the count value exceeds a high count threshold and clearing the delta pressure sensor diagnostic flag if the count value drops below a low count threshold.

21. The system of claim 20 wherein the control computer further includes diagnostic enable logic configured to enable operation of the flag counter only if a number of diagnostic enable conditions are met.

22. The system of claim 20 wherein the control computer is configured to determine engine load as a function of engine fueling;

and wherein one of the number of diagnostic enable conditions corresponds to the engine load being within a predefined range of engine load values.

23. The system of claim 20 wherein the control computer is configured to determine engine output torque percentage;

and wherein one of the number of diagnostic enable conditions corresponds to the engine output torque percentage being within a predefined range of engine output torque percentage values.

5           24.    The system of claim 20 wherein one of the number of diagnostic enable conditions corresponds to the engine speed being within a predefined range of engine speed values.

          25.    The system of claim 20 further including:  
10           an EGR valve responsive to a control signal to control exhaust gas flow therethrough; and  
          an EGR valve position sensor producing a position signal indicative of a position of the EGR valve relative to a reference position;  
          wherein one of the number of diagnostic enable conditions corresponds to the  
15           position signal indicating a position of the EGR valve greater than a predefined EGR valve position.

          26.    The system of claim 20 wherein the diagnostic enable logic is configured to enable operation of the flag counter only if the number of diagnostic enable  
20           conditions are met for a calibratable time period.